PATENT Docket No. 147-25-023 C of C

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors : Kris Kelkar and Anand Kelkar
U.S. Patent No : 6,947,507 B2
Issued : Sept. 20, 2005
Serial No. : 09/989,337
Filed : Nov. 20, 2001 Group Art Unit: 2637

Title: SPATIAL-TEMPORAL METHODS AND SYSTEMS FOR RECEPTION OF NON-LINE-OF-SIGHT COMMUNICATION SIGNALS

Attn: Certificate of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF REQUEST FOR CERTIFICATE OF CORRECTION OFFICE MISTAKE

Sir:

Transmitted herewith is a Request for a Certificate of Correction of Office Mistake, a copy of the February 17, 2005 Amendment, and Form PTO/SB/44 Certificate of Correction.

Respectfully submitted,

Date: 10/18/05

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U:\J\R\CAL AMP\147-25-023 Certificate of Correction Request

CERTIFICATE OF MAILING UNDER 37 CFR 1.8

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First class mail in an envelope addressed to: Attn: Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on the date shown below:

10/18/05
Date

Jennifer Jirkovsky

PATENT Docket No. 147-25-023

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors : Kris Kelkar and Anand Kelkar

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Issued : Sept. 20, 2005

Serial No. : 09/989,337

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Title: SPATIAL-TEMPORAL METHODS AND SYSTEMS FOR RECEPTION OF NON-LINE-OF-SIGHT COMMUNICATION SIGNALS

Attn: Certificate of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION OF OFFICE MISTAKE

Sir:

This is a request for a Certificate of Correction to correct errors made by the PTO in the specification and the claims in the above issued patent. A copy of the Amendment submitted to the PTO on February 17, 2005 with the correct wording is included for your reference. A Certificate of Correction is respectfully requested.

Respectfully submitted,

Dated: 10/18/05

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U:\JJR\CAL AMP\147-25-023 Certificate of Correction Request

PTO/SB/44 (04-05)
Approved for use through 04/30/2007. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,947,507 B2

APPLICATION NO.: 09/989,337

ISSUE DATE : September 20, 2005

INVENTOR(S) : Kris Kelkar; Anand Kelkar

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 2, line 67, "received" should be changed to -- receive --

Column 11, line 43, "received" should be changed to -- receive --

Column 11, line 64, "received" should be changed to -- receive --

Column 13, line 7, in the phrase "...to determine delays", insert -- to determine said time delays --

Column 13, line 10, "signal" should be changed to --signals --

Column 13, line 37, "received" should be changed to -- receive --

Column 15, line 11, "received" should be changed to -- receive --

MAILING ADDRESS OF SENDER (Please do not use customer number below):

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Serial No: 09/989337 Docket No: 147-25-023

Client: CALAMP CORP.

Applicants: KELKAR et al.

Title: SPATIAL-TEMPORAL METHODS AND SYSTEMS FOR RECEPTION OF NON-LINE-OF-SIGHT COMMUNICATION SIGNALS

On, 2/17/05 we mailed:

1. Amendment (15 pages)
2. PTO/SB/06 and PTO/SB/17
3. PTO/SB/21
4. Check No. 23309 in the amount of **$1,600.00**

Due 5/4/05: The PTO received the above on the date stamped on this card.

Docket No. 147-25-023 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of:	:	Group Art Unit: 2637
Applicants: Kelkar, Kris, et al.	:	
Filed: November 20, 2001	:	Examiner: Tran, Khai
Serial No. 09/989,337	:	
For: SPATIAL-TEMPORAL METHODS	:	
AND SYSTEMS FOR RECEPTION OF	:	
NON-LINE-OF-SIGHT	:	
COMMUNICATION SIGNALS	:	

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT

Sir:

In response to the Office Action dated February 4, 2005, please amend the above application as shown in the Amendments to the Specification on page 2 and the Amendments to the Claims which begin on page 3.

CERTIFICATE OF MAILING
I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

February 17, 2005
Date

Jennifer Gnatkowski
Signature

Amendments to the Specification

Please amend the paragraph that begins at page 4, line 17 as follows:

Method embodiments also include the steps of d) coherently downconverting and digitizing the received signals S_{rcvd}, and e) demodulating the combined corrected signal $S_{crctcmb}$ to recover data signals.

Amendments to the Claims

1. (canceled) A method of processing transmit signals Str that are received over a receive channel Crcv which is formed by a plurality of receive paths, the method comprising the steps of:

receiving said transmit signals Str with a plurality of spatially separated antennas to form respective receive signals Srcv;

and

spatially and temporally processing said receive signals Srcv to form a combined corrected signal Scrctcmb that reduces errors in at least one signal parameter.

2. (canceled) The method of claim 1, wherein said transmit signals Str have an average wavelength lavg and said receiving step includes the step of separating said antennas by spaces of substantially lavg/2.

3. (canceled) The method of claim 1, wherein said processing step is preceded by a step of coherently downconverting and digitizing said received signals Srcvd.

4. (canceled) The method of claim 3, wherein said transmit signals Str carry modulated data signals and further including the step of demodulating said combined corrected signal Scrctcmb to recover said data signals.

5. (canceled) The method of claim 1, wherein said signal parameter is a signal preamble.

6. (canceled) The method of claim 1, wherein said signal parameter is a signal code.

7. (canceled) The method of claim 1, wherein said signal parameter is a spreading code.

8. (canceled) The method of claim 1, wherein said signal parameter is a signal modulation.

9. (currently amended) ~~The~~ A method of ~~claim 1~~ processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the method comprising the steps of:

receiving said transmit signals S_{tr} with a plurality of spatially separated antennas to form respective receive signals S_{rcv}; and

spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

wherein said processing step includes the step of correcting said received signals S_{rcvd} to form respective corrected signals S_{crct} that reduce errors in said signal parameter and further including the steps of:

comparing said signal parameter of at least one of said corrected signals S_{crct} to a known corresponding signal parameter to detect a difference; and

altering phase and gain of said corrected signals S_{crct} to reduce said difference below a predetermined threshold and thereby reduce the contribution of an interference signal to said combined corrected signal $S_{crctcmb}$.

10. (currently amended) ~~The~~ A method of ~~claim 1~~ processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the method comprising the steps of:

receiving said transmit signals S_{tr} with a plurality of spatially separated antennas to form respective receive signals S_{rcv}; and

spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

wherein said processing step includes the step of correcting said received signals S_{rcvd} to form respective corrected signals S_{crct} that reduce errors in said signal parameter and further including the steps of:

comparing said signal parameter of at least one of said corrected signals S_{crct} to a known corresponding signal parameter to detect a difference; and

inserting a canceling signal into said corrected signals S_{crct} to reduce said

difference below a predetermined threshold and thereby reduce the contribution of an interference signal to said combined corrected signal $S_{crctcmb}$.

11. (currently amended) ~~The~~ A method of ~~claim 1~~ processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the method comprising the steps of:

receiving said transmit signals S_{tr} with a plurality of spatially separated antennas to form respective received signals S_{rcvd}; and

spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;s

wherein said processing step includes the steps of:

correcting said received signals S_{rcvd} to form respective corrected signals Scrct that reduce temporal errors in said signal parameter; and

combining said corrected signals S_{crct} to reduce spatial errors of said signal parameter in said combined corrected signal $S_{crctcmb}$.

12. (original) The method of claim 11, wherein said correcting step includes the step of equalizing said receive channel C_{rcv}.

13. (currently amended) The method of claim 12, wherein, for each of said received signals S_{rcvd}, said equalizing step includes the steps of:

summing versions of that received signal S_{rcvd} that are modified with respective weights and time delays to form a corrected signal S_{crct};

comparing said signal parameter of said corrected signal S_{crct} and a known corresponding signal parameter to detect a difference; and

updating said weights and time delays to reduce said difference.

14. (currently amended) The method of claim 13, wherein said equalizing step further includes the step of convolving one of said received signals S_{rcvd} with a known version of said signal parameter to determine said time delays.

15. (original) The method of claim 11, wherein said combining step includes the steps of:

providing said corrected signals S_{crct} with respective weights to form said combined corrected signal $S_{crctcmb}$;

comparing said signal parameter of said combined corrected signal $S_{crctcmb}$ and a known corresponding signal parameter to detect a difference; and

updating said weights to reduce said difference.

16. (currently amended) The method of claim 11, wherein said combining step includes the steps of:

comparing a spectrum of at least one of said corrected signals S_{crct} to a spectrum of a known corresponding signal parameter to detect a difference; and

altering phase and gain of said corrected signals S_{crct} to reduce said difference below a predetermined threshold and thereby reduce the contribution of an interference signal to said combined corrected signal Scrctcmb.

17. (currently amended) ~~The~~ A method of ~~claim 1~~ processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the method comprising the steps of:

receiving said transmit signals S_{tr} with a plurality of spatially separated antennas to form respective receive signals S_{rcv}; and

spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

wherein said processing step includes the steps of:

estimating said receive channel C_{rcv} to determine time delays that correspond to said receive paths;

for each determined time delay, summing corresponding received signals S_{rcvd} which are modified by respective weights to provide a respective corrected signal S_{crct} that reduces spatial errors in said signal parameter; and

with their respective time delays, combining all corrected signals S_{crct} derived in said summing step to realize said combined corrected signal

Scrctcmb.

18. (currently amended) The method of claim 17, further including the step of combining the results of said estimating step on at least two of said ~~received~~ signals $S_{rcv\text{~~d~~}}$.

19. (currently amended) The method of claim 17, wherein said estimating step includes the step of convolving one of said ~~received~~ signals $S_{rcv\text{~~d~~}}$ with a known signal parameter that corresponds to said signal parameter of ~~received~~ signals $S_{rcv\text{~~d~~}}$ to determine said time delays.

20. (currently amended) The method of claim 17, wherein said estimating step includes the steps of:

summing versions of one of said ~~received~~ signals $S_{rcv\text{~~d~~}}$ that have respective weights and time delays to form a test signal S_{tst};

comparing said signal parameter of said test signal S_{tst} and a known corresponding signal parameter to detect a difference; and

updating said weights and time delays to reduce said difference.

21. (currently amended) ~~The~~ A method of ~~claim 1~~ processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the method comprising the steps of:

receiving said transmit signals S_{tr} with a plurality of spatially separated antennas to form respective receive signals S_{rcv}; and

spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

wherein said processing step includes the steps of:

for each of said ~~received~~ signals $S_{rcv\text{~~d~~}}$, providing signal versions of that ~~received~~ signal $S_{rcv\text{~~d~~}}$ that have respective weights and time delays;

summing said signal versions of all of said ~~received~~ signals $S_{rcv\text{~~d~~}}$ to form said combined corrected signal $S_{crctcmb}$;

comparing said signal parameter of said combined corrected signal $S_{crctcmb}$ and a known corresponding signal parameter to detect a

difference; and

updating said weights and time delays to reduce said difference.

22. (currently amended) The method of claim 21, wherein said comparing step includes the step of convolving one of said ~~received~~ signals S_{rcv} with a known version of said signal parameter to determine said time delays.

23. (currently amended) The method of claim 22, wherein said weights are complex coefficients.

24. (currently amended) (currently amended) ~~The~~ A method of ~~claim 1~~ processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the method comprising the steps of:

receiving said transmit signals S_{tr} with a plurality of spatially separated antennas to form respective receive signals S_{rcv}; and

spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

estimating said receive channel C_{rcv} to determine time delays and respective weights for reduction of temporal errors in said signal parameter;

applying complex corrections based on of said weights to said signal portions to obtain corrected signals S_{crct}; and

summing said corrected signals S_{crct} to obtain said combined corrected signal $S_{crctcmb}$.

25. (canceled) A receiver system for processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the system comprising:

a plurality of spatially separated antennas that convert said transmit signals S_{tr} to receive signals S_{rcv};

a downconverter system that coherently downconverts said receive signals S_{rcv};

analog-to-digital converters that coherently digitize said receive signals S_{rcv}; and

at least one data processor that is programmed to execute the step of spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter.

26. (canceled) The system of claim 25, wherein said transmit signals S_{tr} have an average wavelength lavg and antennas are separated by spaces of substantially lavg/2.

27. (canceled) The system of claim 25, wherein said transmit signals S_{tr} carry modulated data signals and further including a demodulator that demodulates said combined corrected signal $S_{crctcmb}$ to recover said data signals.

28. (currently amended) ~~The~~ A receiver system ~~of claim 25~~ for processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the system comprising:

a plurality of spatially separated antennas that convert said transmit signals S_{tr} to receive signals S_{rcv};

a downconverter system that coherently downconverts said receive signals S_{rcv};

analog-to-digital converters that coherently digitize said receive signals S_{rcv}; and

at least one data processor that is programmed to execute the step of spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

wherein said downconverter system includes:

downconverters that coherently downconvert and multiplex said receive signals S_{rcv} to different first intermediate signals;

tuners that coherently downconvert said first intermediate signals to second intermediate signals; and

a cable that couples said first intermediate signals to said tuners.

29. (canceled) The system of claim 25, wherein said signal parameter is a signal preamble.

30. (currently amended) ~~The~~ A receiver system ~~of claim 25~~ for processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the system comprising:

a plurality of spatially separated antennas that convert said transmit signals S_{tr} to receive signals S_{rcv};

a downconverter system that coherently downconverts said receive signals S_{rcv};

analog-to-digital converters that coherently digitize said receive signals S_{rcv}; and

at least one data processor that is programmed to execute the step of spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

wherein said processing step includes the steps of:

correcting said received signals S_{rcvd} to form respective corrected signals S_{crct} that reduce temporal errors in said signal parameter; and

combining said corrected signals S_{crct} to reduce spatial errors of said signal parameter in said combined corrected signal $S_{crctcmb}$.

31. (currently amended) ~~The~~ A receiver system ~~of claim 25~~ for processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the system comprising:

a plurality of spatially separated antennas that convert said transmit signals S_{tr} to receive signals S_{rcv};

a downconverter system that coherently downconverts said receive signals S_{rcv};

analog-to-digital converters that coherently digitize said receive signals S_{rcv}; and

at least one data processor that is programmed to execute the step of spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

wherein said processing step includes the steps of:

estimating said receive channel C_{rcv} to determine time delays that correspond to said receive paths;

for each determined time delay, summing corresponding ~~received~~ signals $S_{rcv\text{~~d~~}}$ which are modified by respective weights to provide a respective corrected signal S_{crct} that reduces spatial errors in said signal parameter; and

with their respective time delays, combining all corrected signals S_{crct} derived in said summing step to realize said combined corrected signal $S_{crctcmb}$.

32. (currently amended) ~~The~~ A receiver system ~~of claim 25~~ for processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the system comprising:

a plurality of spatially separated antennas that convert said transmit signals S_{tr} to receive signals S_{rcv};

a downconverter system that coherently downconverts said receive signals S_{rcv};

analog-to-digital converters that coherently digitize said receive signals S_{rcv}; and

at least one data processor that is programmed to execute the step of spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

wherein said processing step includes the steps of:

for each of said ~~received~~ signals $S_{rcv\text{~~d~~}}$, providing signal versions of that ~~received~~ signals $S_{rcv\text{~~d~~}}$ that have respective weights and time delays;

summing said signal versions of all of said ~~received~~ signals $S_{rcv\text{~~d~~}}$ to form said combined corrected signal $S_{crctcmb}$;

comparing said signal parameter of said combined corrected signal $S_{crctcmb}$ and a known corresponding signal parameter to detect a difference; and

updating said weights and time delays to reduce said difference.

33. (currently amended) ~~The~~ A receiver system ~~of claim 25~~ for processing transmit signals S_{tr} that are received over a receive channel C_{rcv} which is formed by a plurality of receive paths, the system comprising:

a plurality of spatially separated antennas that convert said transmit signals S_{tr} to receive signals S_{rcv};

a downconverter system that coherently downconverts said receive signals S_{rcv};

analog-to-digital converters that coherently digitize said receive signals S_{rcv}; and

at least one data processor that is programmed to execute the step of spatially and temporally processing said receive signals S_{rcv} to form a combined corrected signal $S_{crctcmb}$ that reduces errors in at least one signal parameter;

wherein said processing step includes the steps of:

estimating said receive channel C_{rcv} to determine time delays and respective weights for reduction of temporal errors in said signal parameter;

applying complex conjugates of said weights to said signal portions to obtain corrected signals S_{crct}; and

summing said corrected signals S_{crct} to obtain said combined corrected signal $S_{crctcmb}$.

34. (new) The method of claim 9, further including the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

35. (new) The method of claim 10, further including the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

36. (new) The method of claim 11, further including the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

37. (new) The method of claim 17, further including the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

38. (new) The method of claim 21, further including the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

39. (new) The method of claim 24, further including the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

40. (new) The system of claim 30, wherein said processing step further includes the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

41. (new) The system of claim 31, wherein said processing step further includes the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

42. (new) The system of claim 32, wherein said processing step further includes the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

43. (new) The system of claim 33, wherein said processing step further includes the step of selecting said signal parameter from parameters that include signal preamble, signal code, spreading code and signal modulation.

REMARKS

Claims 1-8, 25-27 and 29 have been canceled, claims 9-11, 13, 14, 16-24, 28 and 30-33 have been amended, and claims 34-43 have been added. Claims 9-24, 28 and 30-43 remain in the application.

Minor typographical corrections have been made to a paragraph of the filed specification so that a receive term agrees in tense with its occurrences elsewhere in the specification and claims.

The Examiner stated that claims 9-24, 28 and 30-33 were allowable if rewritten in independent form including all limitations of base and intervening claims.

Accordingly, dependent claims 9-11, 17, 21, 24, 28 and 30-33 have been converted to independent form. Claims 12-16 remain dependent from claim 11, claims 18-20 remain dependent from claim 17, and claims 22 and 23 remain dependent from claim 21.

Claims 34, 35, 36, 37, 38 and 39 have been added to respectively depend from claims 9, 10, 11, 17, 21 and 24. Claims 40, 41, 42 and 43 have been added to respectively depend from claims 30, 31, 32 and 33.

The term "receive signals S_{rcv}" was inadvertently written as "received signals S_{rcvd}" in claims 9-11, 13, 14, 17-22, and 30-32. These typographical errors have been corrected to "receive signals S_{rcv}" to thereby agree with usage elsewhere in the specification and claims. In addition, "signal" has been corrected to "signals" in claims 9 and 16 and a period has been inserted after "23" in claim 23.

Applicants note that because the amendments only correct typographical errors and convert claims to dependent form, they make no substantive changes in the filed language of the claims, are unrelated to statutory requirements for patentability and do not, therefore, alter the scope of the filed claims.

Applicants therefore request an early allowance of claims 9-24, 28 and 30-43.

Respectfully submitted,
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